DETAILED ACTION

Response to Amendment

1. The amendment received on September 17, 2008 has been entered in full.

2. Applicant's arguments with respect to rejected claims as presented in the amendment filed have been fully considered but are moot in view of new ground(s) of rejection(s) made below.

Claim Rejections - 35 USC § 101

3. 35 U.S.C. 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

4. Claims 1-9, 11 and 17 are rejected under 35 U.S.C. 101 as not falling within one of the four statutory categories of invention. While the claims recite a series of steps or acts to be performed, a statutory "process" under 35 U.S.C. 101 must (1) be tied to another statutory category (such as a particular apparatus), or (2) transform underlying subject matter (such as an article or material) to a different state or thing (Reference the May 15, 2008 memorandum issued by Deputy Commissioner for Patent Examining Policy, John J. Love, titled "Clarification of 'Processes' under 35 U.S.C. 101"). The instant claims neither transform underlying subject matter nor positively tie to another statutory category that accomplishes the claimed method steps, and therefore do not qualify as a statutory process.

The memorandum issued can be found at:

http://www.uspto.gov/web/offices/pac/dapp/opla/preognotice/section_101_05_15_2008.pdf

Or,

from uspto.gov, click "Policy and Law", "Patents", "Memorandum to the Examining Corps", "Clarification of "processes" under … 101".

If applicants want a more detailed explanation of this or other Office policy than you can provide, refer them to the Office of Patent Legal Administration (OPLA).

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. Claims 1-9, 11, 17 and 30-32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Manak et al., 1998, "3D data compression of hyperspectral imagery using vector quantization with NDVI- based multiple codebooks", further in view of Sun et al., U.S. Patent No. 6,546,117 B1.

Regarding claim 1, claim 1 recites "a method for compressing multi-dimensional data comprising the steps of: a) receiving the multi-dimensional data comprising a plurality of data vectors of an image of an object". Manak discloses "**3D data compression of hyperspectral imagery using vector quantization with NDVI-based multiple codebooks**" (page 2680, Title of the document, left column – topic- introduction – higher data rates for transmission representing continuous data flow, right column - last paragraph – different land cover types within the scene/image; page 2681, left column).

Manak further discloses "In this paper we use NDVI as a tool to segment the scene of a datacube into n different land cover types (i.e. classes) that occur within the scene. The datacube is then separated in to n sub-sets called Training Sub-sets (TSS), each of which corresponds to a distinct class. Accordingly, while keeping the same number of codevectors, we generate not just a single codebook but n smaller codebooks (called sub-codebooks) of equal size from each TSS. For example, a single codebook of size 256 can be segmented into 8 sub-codebooks of size 32 each, where all 32 codevectors represents the same class, and are used to code only the spectra which belong to that class" (page 2681, left column, 1st para.), where codevectors form a cluster of vectors within the subcodebook within TSS belonging to particular class of spectra and vector similarity is defined by the class. Thus the above citation conforms to the limitation **"separating the plurality of data vectors into at least two clusters based on similarity of the data vectors such that similar data vectors are grouped together into one of said at least two cluster".**

Manak further discloses "The NDVI calculation consists of generating an NDVI image for an input datacube. The NDVI classification step classifies the NDVI image create a classification map, referred to a "class-map". The block of TSS segmentation uses the class map to separate the datacube into an array of n TSS corresponding to the n classes. Each TSS is used independently for training its own sub-codebook in the codebook generation step. The array of n **sub-codebooks is passed to the coding step**, where the class-map is used to match each vector to be compressed with the best codevector from the appropriate sub-codebook" (page 2681, left column, 2nd para.), thus conforming to the limitation "providing each of the at least two clusters to at least a compression engine for processing". Further see figure 1.

Claim 1 further recites the limitation "wherein the data vectors are partitioned into at least two clusters based on the distance of a data vector to the centroid of each of the at least two

clusters". As discussed before, Manak discloses partitioning the data vectors into at least two clusters based on similarity of the data vectors, but do not expressly teach partitioning of data vectors being based on the distance of a data vector to the centroid of each of the at least two clusters. Examiner here asserts that partitioning of data vectors into at least two clusters based on the distance of a data vector to the centroid of each of the at least two clusters is very well known in the art of image segmentation and is further taught by Sun. Sun teaches a method of segmentation of objects in the sequence of images and further teaches "Each data point is an input vector. The input vectors are grouped into clusters. A given cluster has a corresponding centroid value, referred to herein as a prototype vector. The prototype vector corresponds to a weighted centroid (color) for such cluster. The input vectors are allocated into clusters as based upon minimum distance measure, (e.g. minimal distance from the cluster's prototype vector" (col. 2, lines 33-40; col. 6, line 52- col. 9, line 44). Therefore, it would have been obvious to one of ordinary skill in the art at the time of invention was made to combine the teachings of Manak and Sun because both references are directed to the same field of endeavor of image segmentation and Sun's method of segmentation based on the distance from the centroid (which is very well known in the art of image segmentation) would additionally provide each data vector of the pixel a direction based on the center of gravity and thus based on the direction of each data vector would provide a robust and very accurate segmentation of the objects in the image, thus providing an robust partitioning of data vectors into clusters in the presence of noise.

Regarding claim 2, claim 2 recites "wherein the data vectors are partitioned in a geometrically irregular fashion" Manak as discussed in the rejection of claim 1, discloses that the segmentation or separation of data subcodebooks is done based on the class of the spectral data and classes are

separated according to the spectral data and apparently spectral data in an image is partitioned in a geometrically irregular fashion. Further support can be found on page 2682, left column, topic 3.3 - unsupervised classification (natural groupings).

Regarding claim 3, claim 3 recites parallel compressing where each of the at least two clusters is assigned to a respective compression engine of the at least two compression engines for simultaneously processing the at least two clusters. Manak does teach processing at least two clusters but do not teach the parallel processing of the clusters. However, examiner here takes official notice that parallel processing is very well known in the art of image compression using vector quantization. It would have been an obvious choice for one of ordinary skill in the art at the time of invention was made to use parallel processing if the requirement exists for a fast and real time image processing.

Regarding claim 4, Manak discloses determining a plurality of codevectors through training for approximating each of the data vectors of a cluster of the at least two clusters with a fidelity above a predetermined threshold based on the data vectors contained in the cluster and encoding each of the data vectors of a cluster using a codevector of the plurality of codevectors (figure 1; page 2680, right column; page 2681, left column, 2nd para.; page 2680, right column, 2nd para.; topic 3.2 and topics 3.4-3.5 – NDVI values compared to the values (threshold values) for classification into vegetated and non-vegetated cover types).

Regarding claim 5, claim 5 recites "storing the plurality of codevectors in a codebook of a cluster, and storing in an index map of a cluster in index for each of the data vectors in the cluster

indicative of a codevector's location within the codebook of the cluster" Manak as discussed in the rejection of claims 1 and 4 in view of the figure 1, provides encoding of the data vectors of a cluster using a codevector of a cluster using a codevector of the plurality of the plurality of codevectors. Figure 1 further shows that index map and the codebook are also transmitted to the decoding portion and clearly all the information to be transmitted has to be known and stored (e.g. buffered) at the transmitting side before it is transmitted and apparently at the decoding side all the information used in encoding has to be provided that was used in encoding for proper reconstruction of data.

Regarding claim 6, Manak discloses SAMVQ (page 2681, left column, last few lines; topic 3 – successive approximation at multiple stages).

Regarding claim 7, claim 7 has been similarly analyzed and rejected as per the citations for claim 5.

Regarding claim 8, Manak discloses wherein the size of the at least two clusters is approximately similar within limits of difference (page 2682, topic 3.4, left column).

Regarding claim 9, claim 9 recites "adaptively controlling the size of each of the at least two clusters by splitting and merging the at least two clusters". As discussed before in the rejection of previous claims, Manak discloses partitioning the data vectors into the clusters where the cluster size could be adjusted (page 2682, left column - topics 3.3 and 3.4), which being the part of image segmentation. Manak does not expressly teach splitting and merging of at least two clusters.

However, examiner here asserts that merging and splitting of the clusters are very well known in the art of image segmentation of the objects (Official notice taken).. It would have been an obvious for one of ordinary skill in the art at the time of invention was made to use such splitting and merging during segmentation process in order to accurately differentiate objects to be segmented.

Regarding claim 11, claim 11 has been similarly analyzed and rejected as per claims 1 and 4. Manak discloses "**3D data compression of hyperspectral imagery using vector quantization with NDVI-based multiple codebooks**" (page 2680, Title of the document, left column – topic-introduction – higher data rates for transmission representing continuous data flow, right column - last paragraph – different land cover types within the scene/image; page 2681, left column).

Claim 17 has been similarly analyzed and rejected as per claim 1. Manak discloses "**3D data compression of hyperspectral imagery using vector quantization with NDVI-based multiple codebooks**" (page 2680, Title of the document, left column – topic- introduction – higher data rates for transmission representing continuous data flow, right column - last paragraph – different land cover types within the scene/image; page 2681, left column; where image/scene apparently represent a view at a specific period of time, therefore, data vectors of the image are within a specific period of time).

Claims 30-32 has been similarly analyzed and rejected as per claims 1-5.

Examiner note: Examiner has cited particular columns and line numbers in the references as applied to the claims above for the convenience of the applicant. Although the specified citations are representative of the teachings for the art and are applied to the specific limitations within the individual claim, other passages and figures may be applied as well. It is respectfully requested from the applicant in preparing responses, to fully consider the references entirely as potential teachings

all or part of the claimed invention, as well as the context of the passage as taught by the prior art or disclosed by the examiner.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Manav Seth whose telephone number is (571) 272-7456. The examiner can normally be reached on Monday to Friday from 8:30 am to 5:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jingge Wu, can be reached on (571) 272-7429. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

/Manav Seth/
Examiner, Art Unit 2624
October 10, 2008